A Microgravity Experiment to Test Scaling Theory Predictions Near the ^{3}He Liquid-Gas Critical Point

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An experiment called MISTE (Microgravity Scaling Theory Experiment) in being considered by NASA to fly in the LTMPF (Low Temperature Microgravity Physics Facility) on the International Space Station. The motivation for this study comes from the fact that gravity induces a vertical density stratification in ground-based experiments that excludes precision measurements in the asymptotic region close to the liquid-gas critical point. The MISTE experiment is being designed to perform continuous in-situ PVT, specific heat at constant volume, and isothermal susceptibility measurements throughout the critical region of ^{3}He. Measurements are planned to determine critical exponents and amplitudes along the critical isochore, critical isotherm, and coexistence curve in the asymptotic region. The techniques being developed for the flight experiment will be discussed. These measurements will test the predictions of asymptotic equation-of- state models. The experimentally determined asymptotic amplitudes coupled with precision ground-based data taken farther away from the transition will also be used to test crossover theories. Recent measurements of the specific heat along the critical isochore and isothermal susceptibility throughout the critical region will be presented.